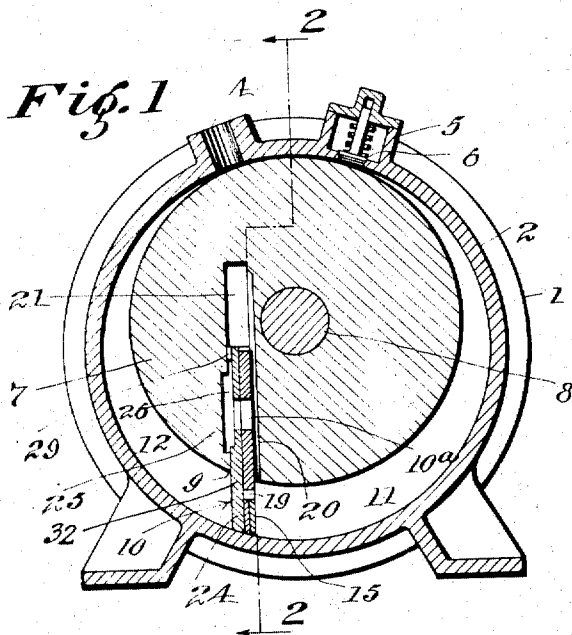
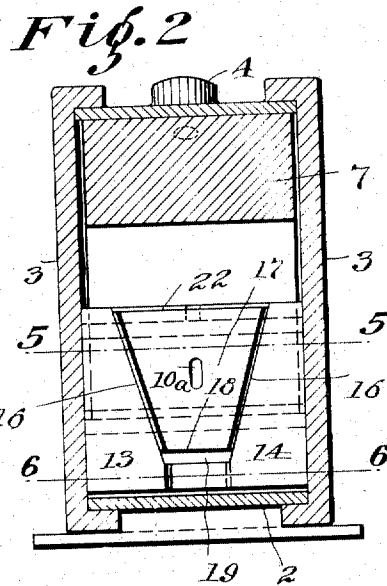
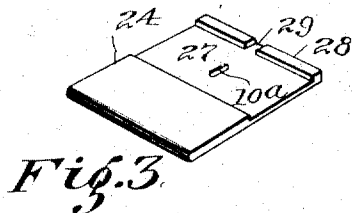
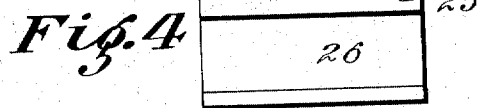
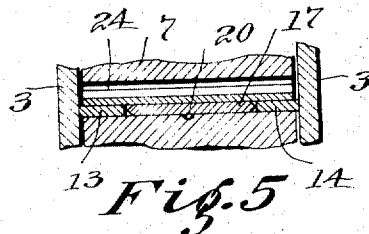
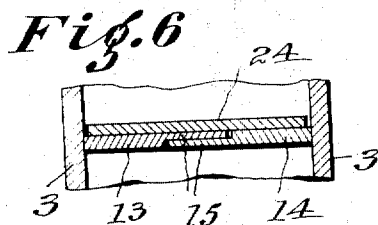
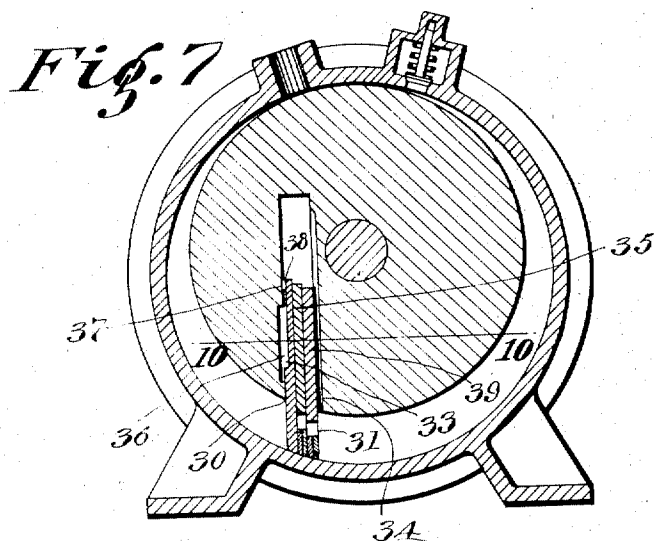
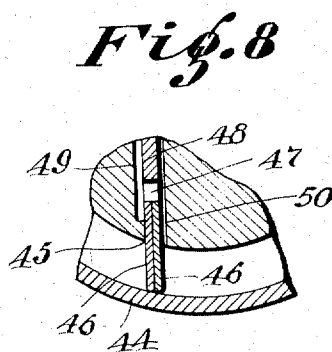
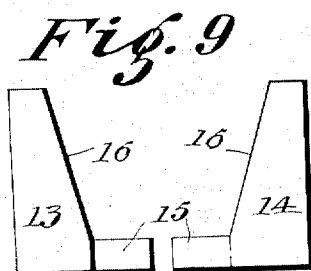
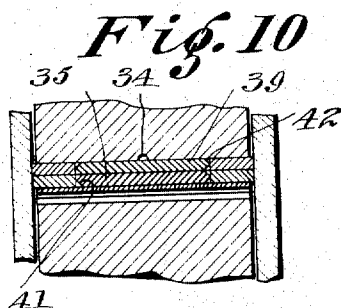
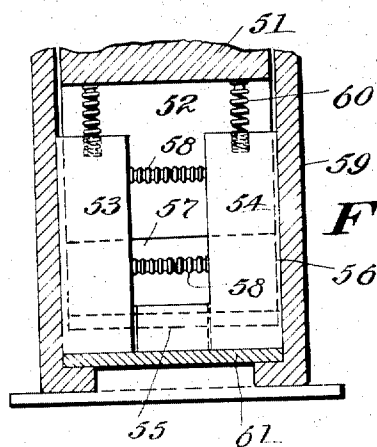
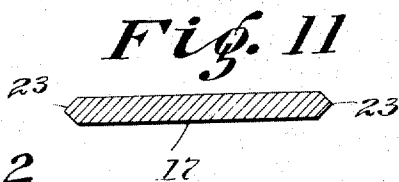


1,280,306.



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UNITED STATES PATENT OFFICE.

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ROTARY-PISTON PACKING.

1,280,306.

Specification of Letters Patent.

Patented Oct. 1, 1918.

Application filed May 19, 1917. Serial No. 169,617.

To all whom it may concern:

Be it known that I, WALTER G. E. ROLAFF, a citizen of the United States, residing in the town of Belleville, county of St. Clair, and State of Illinois, have invented new and useful Improvements in Rotary-Piston Packings, of which the following is a specification.

This invention relates to air compressors, pumps and similar machines, and the invention is particularly applicable to high speed machines of rotary type. The type of machine to which I have described my invention, as applied includes a cylindrical case in which there is mounted a rotary piston consisting of an eccentrically mounted drum, and a blade which engages the walls of the cylinder. One of the difficulties in operating pumps or compressors of this type arises from the fact that it is necessary to pack the piston blade in order to prevent leakage past the blade as the piston rotates.

The general object of my invention is to produce a machine of this type having improved means for effectively packing the piston so as to reduce as far as possible the leakage past the piston as it rotates. One of my objects is to accomplish this by a very simple construction for the piston blade. One of the difficulties arising in this type of machine is due to the fact that the pressure in the compression chamber of the cylinder, which is exerted upon the forward face of the driving side of the piston blade operates to press the blade with great force against the side of its guide in the drum, and this develops a high frictional resistance to the inward and outward movement of the blade, which must take place as the piston revolves. One of the objects of my invention is to provide means for equalizing the pressure on this blade, and thereby prevent the development of this frictional resistance. Furthermore, I provide means whereby the centrifugal force acting upon a portion of the blade maintains the packing plates in engagement with the cylinder wall, and the parts are so organized that the fluid pressures on the parts are substantially balanced.

Further objects of the invention will appear hereinafter.

In the drawing which fully illustrates an embodiment of my invention as applied to a machine of the type referred to,

Figure 1 represents a vertical cross-section through a pump or air compressor or similar machine for compressing or pumping a fluid;

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1;

Fig. 3 is a perspective of a backing plate which may be embodied in the construction;

Fig. 4 is an elevation of the lower portion of the driving face of the piston drum;

Fig. 5 is a cross-section on the line 5—5 of Fig. 2;

Fig. 6 is a cross-section on the line 6—6 of Fig. 2;

Fig. 7 is a vertical cross-section through one of these machines showing a modified construction for the piston blade;

Fig. 8 is a vertical section similar to Fig. 7 but showing a simple construction for the blade;

Fig. 9 is a side elevation showing two of the packing blades;

Fig. 10 is a horizontal section taken on the line 10—10 of Fig. 7;

Fig. 11 is a cross-section through one of the plates which may constitute a feature of the construction;

Fig. 12 is a vertical section taken similarly to the section 2—2 but illustrating an embodiment of the invention in which springs are employed for holding the packing plates against the cylinder walls.

Referring more particularly to the parts, 1 represents a casing or barrel having a cylindrical wall 2 and two heads 3, 3. This casing is provided at a suitable point with an inlet opening 4 for admitting the fluid to be compressed or pumped, and is further provided with a suitable outlet 5 and an outlet valve which may be in the form of a check valve 6. Within this barrel there is eccentrically mounted a rotary piston comprising a cylindrical drum 7 secured to a shaft 8. This drum may be of solid form as shown, in which case the weight of the drum gives the drum the effect of a fly wheel. This drum is provided with a guide preferably in the form of a slot 9 which extends throughout the entire length of the drum, and in a direction such as that indicated, that is to say, the slot is formed so that it will operate as a guide for a blade 10 which forms a part of the piston. This blade is so constructed that its parts will maintain engagement with the walls of the

cylinder, and produces a packing effect so that when the drum is rotated in a left hand direction, the fluid under pressure in the compression chamber or working chamber 11 will not have an opportunity to find its way past the blade 10 into the suction chamber 12 of the machine.

In order to get this packing effect, I prefer to provide a pair of packing plates 13 and 14. Cooperating with these packing plates I provide means in the form of an actuator plate cooperating with the packing plates to spread them and force them outwardly in order to maintain them in engagement with the heads and the cylindrical wall. This means may be controlled by the centrifugal force. To accomplish this the packing plates are of tapered form, see Fig. 9, and have overlapping tongues 15 which are of reduced thickness so as to produce the effect of a scarf joint. Between the inclined adjacent edges 16 a wedge-shaped space is formed, and in this space I provide a freely movable centrifugal wedge plate 17, the side edges of which engage the inclined edges 16. Between the outer edge 18 of this wedge plate and the tongues 15 a recess 19 is formed illustrated in the embodiment of the invention shown in Fig. 1, and this recess is in communication with the compression chamber 11; hence a force would be developed tending to shove the wedge plate inwardly.

In order to balance the forces operating on the inner and outer edges of the wedge plate I prefer to provide a duct 20 on the forward side of the slot 9 which maintains communication from the compression chamber 11 to a back chamber 21, which is formed in the bottom of the slot behind the rear end or edge of the blade 10. Hence, when the machine is in operation the same pressure is exerted on the rear edge 22 of the wedge plate as is exerted on the outer edge 18. As the area of these two edges is different by reason of the taper of the wedge plate, an unbalancing effect might result tending to produce an excessive pressure on the inner edge 22 which would tend to force the wedge plate outwardly, and this might produce a jamming effect and press the packing plates 13 and 14 apart with too much force. In order to substantially balance the pressure on the edges of this plate I provide the wedge plate with beveled side edges 23, which expose the edges to the fluid pressure. It will appear that at these beveled edges ducts will be formed which will open communication with the back chamber 21, which would tend to render the duct 20 unnecessary, but I prefer to provide the duct 20 so as to insure that sufficient area of inlet is afforded to be certain that the pressure in the back chamber will be substantially equal to that existing in the compression chamber 11. The blade 10 prefer-

ably includes a backing plate 24 which is simply a rectangular plate superposed upon the packing plates 13 and 14, and the wedge plate 17, and lying in the slot 21. This backing plate 24 closes the gap 19 and cooperates with the other plates to form a substantially nonleaking blade. With a construction such as this it is evident that when the machine is in operation a considerable force is exerted on the driving side of the projecting end of the blade 10, and this force would tend to hold the blade forcibly against the rear wall 25 of the slot. I provide means for counter-balancing this driving force so as to substantially equalize the lateral forces acting upon opposite sides of the blade. For this purpose I prefer to form an equalizing chamber 26 which may be cut in the face of the wall 25 of the slot, and opposite this point I form a large recess 27 in the opposing face of the backing plate. This wide recess 27 leaves a narrow rib or wear-strip 28 near the inner edge of the plate 24. I provide means for maintaining communication between this equalizing chamber 26 and the compression chamber 11, and this is very simply accomplished by forming a notch 29 in the wear strip 28. I also prefer to maintain communication from the duct to the equalizing chamber, and this may be done by means of slots 10^a through the plates 17 and 24. As the plates fit loosely in the guide slot 9 the fluid pressure is exerted over the entire area of the front or working side of the blade. With such an organization of parts as that described, it is evident that the pressure will be developed on the rear side of the blade that is, on the side remote from the working side, as well as on the forward or working side, and the forces developed by these pressures substantially equalize each other, because the area exposed on the back of the plate increases with every increase in the area of the blade portion within the slot. There is always a slight excess of force on the front side however, so that a slight frictional resistance is offered to the inward and outward sliding movement of the blade as the piston rotates.

If it is desired to produce an even more efficient packing effect, an increased number of packing plates may be employed, for example, I may adopt an organization such as shown in Fig. 7.

The main features of this embodiment of the invention are the same as those described in Fig. 1, except that the guide slot 30 for the blade is made wide enough to accommodate two pairs of packing plates 31 superposed upon each other with a backing plate 32 between them and the driving wall 25 of the slot 9. The construction of the packing plates is substantially the same as that described above. The backing plate 32 is

of rectangular form as before. The rear face of the backing plate is provided with a recess 38. Opposite this recess 38, an equalizing chamber 36 is cut in the rear wall of the guide, and the fluid pressure is admitted to this equalizing chamber through a notch 37 formed in the wear strip 28 of the backing plate. It is evident that a blade, the parts of which are organized in this way will be packed more effectively, and the lateral forces on the blade will be balanced in substantially the same way as before. Furthermore, the wedge plates 35 and 39 are provided with beveled edges 41 and 42, respectively which operate to balance the pressure on the edges of these wedge plates in the manner already explained. In this form of the invention the fluid pressure from the compression chamber 43 is admitted to the back chamber by a groove 34.

If desired I may omit the backing plate, and the organization of parts will then be such as illustrated in Fig. 8, in which 44 represents the cylindrical wall and 45 indicates the guide slot in the drum. The packing plates have substantially the same form as the plates 13 and 14, except that the tongues 46 are wide enough to insure that the gap 47 formed between their upper edges and the wedge plate 48 will always lie within the slot 45. The guide slot 45 is provided with an equalizing chamber 49 which receives the fluid pressure through the gap 47 from a duct 50 similar to the duct 20. This embodiment is even simpler than that shown in Fig. 1, and will produce a substantially tight packing for the piston.

I may dispense with the wedge plates in which case I may force the packing plates against the cylinder walls by means of springs. Fig. 12 shows an embodiment of this nature, in which 51 represents the drum and 52 represents the guide slot in its wall. In this guide slot I provide two packing plates 53 and 54 which have overlapping tongues 55 constructed like the tongues shown in Fig. 6. The dotted line 56 indicates the outer end of the slot 52 so that the tongues substantially fill the slot. The driving face of the slot 52 has an equalizing chamber 57 cut into it to admit the fluid pressure in the rear sides of the plates 53 and 54.

A pair of springs 58 are disposed between the edges of the plates 53 and 54 and maintain them against the cylinder heads 59. In the back end of the slot 52 I provide springs 60 which tend to force the packing plates outwardly against the cylinder wall 61. Evidently in this embodiment of the invention the packing effect is not wholly dependent upon the action of centrifugal force and consequently I prefer this embodiment in larger size machines, where the speed is

relatively lower and where the packing plates are of sufficient thickness to enable springs to be used.

While my invention has been described as applied to a compressor or pump, it is evident that it is equally applicable to steam engines or air motors or other machines operated by, or operating upon a fluid. Furthermore, in using the term "working side" in the specification and claims, it is understood that this term means the side of the blade on which the pressure is being exerted; in a compressor or pump of course this would be the forward side of the blade with respect to the direction of rotation, but in a steam engine or air motor, the working side would be the rear side of the blade.

It is understood that the embodiment of the invention described herein is only one of the many forms or embodiments this invention may take, and I do not wish to be limited in the practice of my invention, nor in my claims to the particular embodiment set forth.

What I claim is:—

1. In a machine of the class described, the combination of a barrel to receive a fluid, and having heads, a rotary drum eccentrically mounted in said barrel, a blade guided to slide in and out in said drum as the drum rotates, and including a pair of packing plates for engaging the heads of said barrel, said drum having a pressure equalizing chamber on the rear side of said blade remote from the working side of said blade, and means for maintaining communication between said equalizing chamber and the working chamber of the barrel to equalize the lateral forces exerted on the opposite sides of said blade.

2. In a machine of the class described, the combination of a barrel to receive a fluid, and having heads, a rotary drum eccentrically mounted in said barrel, a blade guided to slide in and out in said drum as the drum rotates, and including a pair of packing plates for engaging the heads of said barrel, and a backing plate superposed on said packing plates to cooperate therewith, said drum having a pressure equalizing chamber on the side of said blade remote from the working side of said blade, and means for maintaining communication between said equalizing chamber and the working chamber of the barrel to equalize the lateral forces exerted on the opposite sides of said blade.

3. In a machine of the class described, the combination of a barrel to receive a fluid, and having heads, a rotary drum eccentrically mounted in said barrel, a blade guided to slide in and out in said drum as the drum rotates, and including a pair of packing plates for engaging the heads of said barrel, and the inner side of the cylindrical wall of said barrel, a backing plate superposed on

said packing plates to cooperate therewith, an actuator plate actuated in an outward direction by centrifugal force to cooperate with said packing plates to hold the same against the cylindrical wall of the barrel and against said heads, said drum having a pressure-equalizing chamber on the side of said blade remote from the working side of said blade, and means for maintaining communication between the equalizing chamber and the working chamber of the barrel to equalize the lateral forces exerted on the opposite sides of said backing plate and said packing plates.

4. In a machine of the class described, the combination of a barrel having heads, a rotary drum eccentrically mounted in said barrel, and having a guide slot therein, a blade including a pair of packing plates mounted to move in and out of said guide slot as the drum rotates, and cooperating with said guide slot to form a back chamber at the inner edge of said blade, said back chamber communicating with the compression chamber of the barrel whereby substantially the same pressure is maintained in said back chamber and said guide slot, and a wedge plate disposed between said packing plates and operating when moved outwardly by centrifugal force to hold said packing plates against said heads, the ends of said wedge plate being exposed to the pressure of the fluid and the side edges of said wedge plate being also exposed to the pressure of the fluid whereby the fluid pressure on the ends of said wedge plate is substantially balanced.

5. In a machine of the class described, the combination of a barrel having heads, a rotary drum eccentrically mounted in said barrel, and having a guide slot therein, a blade including a pair of packing plates mounted to move in and out of said guide slot as the drum rotates, and cooperating with said guide slot to form a back chamber at the inner edge of said blade, the wall of said slot having a pressure-equalizing chamber formed in the face thereof on the rear side of said blade remote from the driving side of said blade communicating with said back chamber, and having means for maintaining communication between said back chamber and the compression chamber of the barrel to equalize the lateral forces exerted on opposite sides of said blade, and a wedge plate disposed between said packing plates, and tending to spread the same when said wedge plate moves in an outward direction, to hold said packing plates against said heads.

6. Packing means for packing a rotary piston in its cylinder, comprising the combination of a pair of packing plates for engaging the wall of the cylinder, said packing plates being of tapered form, so as to

form a wedge-shaped space therebetween, a wedgeplate disposed in the space between said packing plates, and constructed so as to be forced outwardly solely by the centrifugal force acting thereupon to force said packing plates apart, and means for maintaining fluid pressure on the inner and outer edges of said wedge plate, said wedge plate having beveled side edges engaging said packing plates, and exposed to the fluid pressure to balance the pressure on the edges of said wedge plates.

7. Packing means for packing a rotary piston in its cylinder, consisting of a pair of packing plates having overlapping outer edges, said packing plates being of tapered form so as to present a wedge-shaped space there between, and a wedge-plate received between said packing plates, the inner and outer edges of said wedge plate being exposed to the same pressure, said plate having beveled side edges exposed to the said pressure engaging said packing plates to balance the forces acting on the inner and outer edges of said wedge plate, said wedge plate being actuated in an outward direction by the centrifugal force to spread said packing plates, and hold them against the cylinder walls.

8. In a machine of the class described, the combination of a barrel having heads, and a cylindrical wall, a rotary piston mounted therein including a projecting blade, and having a back chamber at the inner edge of said blade, said blade comprising a pair of packing plates with overlapping tongues adjacent the cylindrical wall, said packing plates being of tapered form so as to present a wedge-shaped space there between, a freely movable wedge-plate disposed between said packing plates, mounted so as to be actuated in an outward direction solely by the centrifugal force to spread said packing plates and hold the same against said heads, and means for balancing the lateral forces acting on opposite sides of said blade.

9. In a machine of the class described, the combination of a barrel having heads, and a cylindrical wall, a rotary piston mounted therein including a projecting blade, and having a back chamber at the inner edge of said blade, said blade comprising a pair of packing plates with overlapping tongues adjacent the cylindrical wall, said plates being of tapered form so as to present a wedge-shaped space therebetween, a wedge-plate disposed between said packing plates, and actuated in an outward direction solely by the centrifugal force to spread said packing plates and hold the same against said heads, means for balancing the lateral forces acting on said blade, and means for balancing the pressures on the inner and outer edges of said wedge plate.

10. In a machine of the class described,

the combination of a barrel having a cylindrical wall and heads, an eccentrically mounted drum within said barrel having a guide slot therein, a blade for engaging said
 5 cylindrical wall and said heads, guided in said guide slot, said blade cooperating with said guide slot to form a back chamber at the inner edge of said blade, said drum having a duct maintaining communication between
 10 the compression chamber of the cylinder and said back chamber, an equalizing chamber formed in the rear wall of said guide, said blade including a pair of tapered packing plates engaging said heads and said cylindrical wall, and having overlapping tongues
 15 adjacent said cylindrical wall, a wedge plate disposed in the space between said packing

plates and operating to spread the same to hold said packing plates against the walls of the cylinder, said wedge plate having beveled edges, and having its inner edge exposed to the fluid pressure to balance the inward and outward pressure on said wedge plate, and a backing plate in said guide slot superposed on said packing plates and
 20 cooperating therewith, and means for maintaining communication from said back chamber to said equalizing chamber to equalize the lateral forces acting on said blade.
 30

In testimony whereof, I have hereunto set my hand.

WALTER G. E. ROLAFF.